

**WHAT IS CLAIMED IS:**

1. A medical stand apparatus comprising:

a base fixed to a patient table at a position away from the floor;

5 a horizontally rotatable member attached to the base, the horizontally rotatable member being articulated about a predetermined axis of rotation;

10 a parallel link mechanism made of a combination of a pair of parallel longitudinal links and a pair of lateral links, the parallel link mechanism being supported by a first articulation arranged on the horizontally rotatable member;

15 a support arm extending from the upper lateral link of the parallel link mechanism, a front end of the support arm supporting an end link whose lower end supports a medical equipment;

20 a counterweight opposite the medical equipment across the first articulation, the counterweight canceling weight acting in an inclining direction of the parallel link mechanism about the articulation and keeping the medical equipment at an optional spatial position;

a crank articulated about second articulation of the parallel link mechanism, the second articulation serving as a start point of the support arm;

25 a longitudinal sub-link parallel with the longitudinal links, a lower end of the longitudinal sub-link being articulated at a front end of a protrusion formed on the horizontally rotatable member, one of the longitudinal links adjacent to the support arm, the crank, the longitudinal sub-link, and the protrusion forming a first auxiliary parallel link mechanism; and

30 a lateral sub-link parallel with the support arm and connected to the longitudinal sub-link through the crank, an upper end of the end link being articulated at an end of the lateral sub-link opposite the crank, the support arm, the upper end of the end link, the lateral sub-link, and the crank forming a second auxiliary parallel link mechanism.

2. A medical stand apparatus comprising:

a base set on the floor, the base having a post installed on the base, the post being horizontally articulated about an axis of rotation oriented in a predetermined direction with

respect to the base, the post being provided with upper and lower articulations;

5 a parallel link mechanism supported by the upper articulation, the parallel link having a pair of parallel longitudinal links and a pair of lateral links;

a support arm extending from the upper lateral link of the parallel link mechanism, a front end of the support arm supporting an end link;

10 a crank articulated about a first articulation of the parallel link mechanism, the first articulation serving as a start point of the support arm;

15 a longitudinal sub-link parallel with the longitudinal links, a lower end of the longitudinal sub-link being articulated at a front end of a horizontal first upper protrusion formed on the post, one of the longitudinal links adjacent to the support arm, the crank, the longitudinal sub-link, and the first upper protrusion forming a first auxiliary parallel link;

20 a lateral sub-link parallel with the support arm, the lateral sub-link cooperatively moving in response to position of the longitudinal sub-link through the crank, an upper end of the end link being articulated at a first end of the lateral sub-link opposite the crank, the support arm, the upper end of the end link, the lateral sub-link, and the crank forming a second auxiliary parallel link;

25 an interlocked longitudinal link always parallel with the longitudinal links, an upper end of the interlocked longitudinal link being articulated at the lower articulation, a lower end of the interlocked longitudinal link being articulated at a first end of an interlocked lateral link;

30 a second upper protrusion formed at a lower end of the longitudinal links, a front end of the second upper protrusion being connected to a front end of a lower protrusion formed at an upper end of the interlocked longitudinal link through an interlocked longitudinal sub-link, the orientation and length of a straight line between upper and lower articulations of the interlocked longitudinal sub-link being equal to those of a straight line between the upper and lower articulations;

35 a weight link connecting an end of the lower lateral link of the parallel link mechanism opposite the medical equipment and a second end of the interlocked lateral link, the weight

link being parallel with a straight line between the upper articulation and the first end of the interlocked lateral link; and

5 a counterweight arranged at the second end of the interlocked lateral link,

the counterweight cooperatively moving toward and away from the lower articulation in response to movement of the medical equipment about the upper articulation, the weight of the counterweight acting on the parallel link mechanism to keep the 10 medical equipment at an optional spatial position.

3. The medical stand apparatus of claim 2, wherein  
the lower articulation is offset from just below the upper  
articulation toward the medical equipment.

15 4. The medical stand apparatus of claims 1 or 2, wherein:  
a rotary arm is articulated at a third articulation formed  
at the end link, the rotary arm having a forth articulation,  
a holder to hold the medical equipment being articulated at the  
20 forth articulation, each principal axis of rotation of the third  
articulation and the forth articulation intersecting; and  
the intersection is set to agree with the gravitational  
center of the medical equipment.

25 5. The medical stand apparatus of 4 wherein each principal axis  
of rotation of the third articulation and the fourth articulation  
are substantially orthogonal to each other.

30 6. An assist-less medical stand apparatus for manipulating a  
medical equipment used for a patient on a patient table  
comprising:

35 a first parallel linkage for weight balancing of the  
apparatus having a first articulating element, a second  
articulating element, a third articulating element, and a fourth  
articulating element,

40 the first articulating element and the second articulating  
element being linked by a first linkage, the second articulating  
element and the third articulating element being linked by a  
second linkage, the third articulating element and the fourth  
articulating element being linked by a third linkage, the fourth

articulating element and the first articulating element being linked by a fourth linkage, the third articulating element supporting a counterweight, the first linkage being articulated by a fifth articulating element on a supporting member, and the 5 supporting member fixing the apparatus with respect to the patient table;

10 a second parallel linkage having a sixth articulating element, a seventh articulating element, a eighth articulating element, and a ninth articulating element,

15 the sixth articulating element and the seventh articulating element being linked by a sixth linkage, the seventh articulating element and the eighth articulating element being linked by a seventh linkage, the eighth articulating element and the ninth articulating element being linked by a eighth linkage, the ninth articulating element and the sixth articulating element being linked by a fifth linkage, the sixth linkage being fixed with respect to the supporting member, and the fifth linkage and the first linkage being fixed each other; and

20 a third parallel linkage to cooperatively move with the second parallel linkage for holding the medical equipment and keeping a position thereof having a tenth articulating element, a eleventh articulating element, a twelfth articulating element, and a thirteenth articulating element,

25 the tenth articulating element and the eleventh articulating element being linked by a ninth linkage, the eleventh articulating element and the twelfth articulating element being linked by a tenth linkage, the twelfth articulating element and the thirteenth articulating element being linked by a eleventh linkage, the thirteenth articulating element and the tenth articulating element being linked by a twelfth linkage, the thirteenth articulating element being fixed by the fourth linkage, the tenth articulating element, the ninth articulating element, and the first articulating element being fixed each other, and the eleventh articulating element and the eighth articulating 30 element being linked by a thirteenth linkage.

35 7. An assist-less medical stand apparatus for manipulating a medical equipment used for a patient on a patient table comprising:  
40 a first articulation positioned at a first end of a first link;

a second articulation positioned at a second end of the first link, the second articulation being arranged at a predetermined position on a base;

5 a third articulation positioned at a first end of a second link;

a fourth articulation positioned at a second end of the second link, the first articulation, the third articulation, the fourth articulation, and the second articulation forming a first parallel link mechanism;

10 a fifth articulation positioned at a first end of a third link at a predetermined position with respect to the base;

a sixth articulation positioned at a second end of the third link, the first articulation, the sixth articulation, the fifth articulation, and the second articulation forming a second parallel link mechanism;

15 a seventh articulation positioned at a front end of a support arm extending from the first articulation;

an eighth articulation positioned at a first end of a fourth link;

20 a ninth articulation positioned at a second end of the fourth link, the eighth articulation and the ninth articulation being linked by an end link for holding the medical equipment and keeping a position thereof, the eighth articulation, the ninth articulation, the seventh articulation, and the first articulation forming a third parallel link mechanism;

25 a tenth articulation positioned below the second articulation on the base;

an eleventh articulation positioned at a first end of a fifth link;

30 a twelfth articulation positioned at a second end of the fifth link, and the second articulation, the eleventh articulation, the twelfth articulation, and the tenth articulation forming a fourth parallel link mechanism;

35 a thirteenth articulation positioned at a first end of a sixth link and supporting a counterweight, and a second end of the sixth link being articulated on the fourth articulation;

and

40 a fourteenth articulation positioned at a first end of a seventh link, a second end of the seventh link being articulated on the thirteenth articulation, wherein:

the third and second parallel link mechanisms cooperate with each other through a linkage between the sixth and eighth articulations; and

5 the tenth and fourteenth articulations are linked with an eighth link which cooperates with the fourth parallel link mechanism.

8. The apparatus of claims 6, wherein:

10 the supporting member is attached to the patient table; the supporting member has a fourteenth articulating element;

the fifth articulating element is articulated about an axis of rotation of the fourteenth articulating element; and

15 weight balancing is realized about an axis of rotation of the fourteenth articulating element.

9. The apparatus of claim 7, wherein

the tenth articulation is offset from just below the second articulation toward the medical equipment.

20 10. The apparatus of claim 7 wherein the base is set on the floor.

11. The apparatus of claim 6, further comprising:

25 a thirteenth articulating element fixed to the eleventh linkage; and

30 a rotary arm for holding the medical equipment articulated by the thirteenth articulating element, the rotary arm having a holder articulated thereon by a fourteenth articulating element, principal axis of rotation of the thirteenth articulating element and that of the fourteenth articulating element intersecting, and the intersection being set to agree with the gravitational center of the medical equipment.

35 12. The apparatus of claim 7, further comprising a rotary arm articulated on the end link about a first principal axis of rotation, the rotary arm having a holder articulated on the rotary arm about a second principal axis of rotation, the first principal axis of rotation and the second principal axis of rotation intersecting, and the intersection being set to agree with the gravitational center of the medical equipment.

13. The apparatus of claim 11 wherein principal axis of rotation of the thirteenth articulation element and that of the fourteenth articulation element are substantially orthogonal to each other.

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14. The apparatus of claim 12 wherein the first principal axis of rotation and the second principal axis of rotation are substantially orthogonal to each other.